



Ø BEAT

COLO. SPRINGS,
COLORADO

MAY 1983

In The Works... Mailbox In The Sky!

The following article is a paper presented at the Amateur Radio Computer Network Conference in San Francisco in March. It will conclude in next month's issue. Our thanks to Andy Freeborn NØCCZ for passing it along.

THE PACSAT PROJECT

Den Connors, KD2S

PACSAT Project Manager

Radio Amateur Satellite Corporation—AMSAT

AMSAT has begun the design and development of a new form of Amateur Satellite. The PACSAT series of satellite systems has as a design goal total global access by all hams to a store-and-forward packet radio message handler.

Introduction

AMSAT is proposing the design and prototyping of a satellite-based experiment for advanced digital packet satellite communications experiments. This system, called PACSAT, will use internationally-allocated Amateur Radio Service frequencies. The PACSAT system will connect a grid of ground-based amateur radio local area networks in the United States and many other countries via a common store-and-forward packet repeater operating in the Amateur Satellite Service.

This paper details the reasons behind such a satellite. Following the design concepts, a description of the entire system is given, and a list of technical parameters for each of the defined subsystems is shown. The current outline of tasks and scheduling follows, with a description of the efforts of groups already engaged in the initial design effort.

The PACSAT Concept

The Amateur Radio communities in the United States and other countries are currently experimenting with digital networks on radio channels. These networks are using techniques already in place on the national telecommunication networks known collectively as packet networking.

Packet radio systems have a set of benefits unusual in present amateur radio systems. Large numbers of stations may share a common frequency, and use multiple access packet techniques to multiplex several sets of users in the time domain; very high spectrum utilization is accomplished by keeping all of these users on the same channel. A second benefit of the single shared channel is the ability to find all other users of the packet radio system. No searching of a wide band of frequencies is required; connectivity is maximized. The need of multiple access techniques to detect successful transmissions yields a third benefit, that of reliable transmissions. Any message that arrives at destination has had its data integrity checked. This inherent reliability may well open a series of possibilities for improving emergency traffic handling, one of amateur radio's most important aspects.

As experiments continue on ground-based packet radio local area networks, a new class of satellite is being considered to handle linking of both individual ground stations and local area networks. The PACKET radio SATellite (PACSAT) system is designed to provide a store-and-forward digital repeater which is available to all groups around the world for fully global network coverage. The satellite provides this coverage by occupying a low-earth orbit (LEO), which has several benefits. The close proximity of passage, relative to geosynchronous satellite, allows easy access, with good "link margins". There are thousands of amateur radio earth stations that are already configured to operate on this class of satellite. Additionally, proper choice of orbital parameters allows a sun-synchronous orbit, where passage of the satellite occurs at the same times each day, providing an easy means of scheduling transmissions. This orbit then provides both 100% global coverage and very fair access, and creates a powerful new use of a well-known class of amateur satellite.

(continued on page 4)

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The Pikes Peak Radio Amateur Association meets on the second Wednesday of every month at the First United Methodist Church, 420 N. Nevada, at 7:30 p.m. All amateurs and interested parties are invited to attend.

Editor: Don Lohse KBØKQ, 1410 E. LaSalle, Colorado Springs, CO 80907 635-7469

MEETING MINUTES

The April meeting of the Pikes Peak Radio Amateur Association was called to order by President Dave Vierling at 7:37, and the members introduced themselves.

Committee reports were given, indicating the Novice classes were proceeding, no RFI had been reported, and Zero Beat was still being published.

Ken Keyte, WØTGL made a presentation on the progress of the Sports Festival planning, mainly covering the caravans that will cover the state promoting the Festival. The commemorative station at OTC was discussed, but is still undecided, pending approval.

The upcoming swapfest was discussed, and ticket sales were encouraged to help defray the costs of the door prizes and to help with the purchase of next years prizes. Plans were made to set up the tables on Saturday the 21st at the Polka Club.

After break, a NASA film was shown and general discussion followed.

Respectfully submitted,
KBØKQ for KAØJXW/DV

MEETING NOTICE

The May meeting of the Pikes Peak Radio Amateur Association will be held on May 11 at 7:30 p.m. at the **Palmer House Motel on N. Chestnut Street (just north of I-25 and Fillmore.)** A clinic to help everyone make sure their equipment is up and running properly for the National Sports Festival will be held. Sign ups for the Festival will be taken — and if you want to work a particular event, come and put your name on the line. All members and other interested persons are encouraged to attend.

SPORTS FESTIVAL CORRECTION

The location for the opening ceremonies of the Sports Festival was listed last month as Garry Berry Stadium. This is incorrect!!! The correct location is the Air Force Academy Stadium. Please note this change.

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MATCHING 75 OHM HARDLINE INTO 52 OHM ANTENNA SYSTEMS

One important item that is sometimes neglected in VHF stations, especially those of the more serious amateurs, is the coax that connects the antenna to the transmitter/receiver or transceiver. Many just pick up a length of any RG-8 type coax and "hook it up".

Most new hams are not aware of some problems that exist with many brands of RG-8 that are available. Since MIL-C17D specifications were dropped for RG-8, its quality has significantly deteriorated. The most evident problem is the lack of "full" braid coverage, which causes additional loss and/or signal "feed thru" because of inadequate shielding at VHF frequencies. If you must use a coax of this type, I recommend your using type RG-213/U which meets MIL-C17D specifications.

Since only slightly more than 50% of your transmitter's output power will reach your antenna in a 100 foot run of RG-8 type coax and receiver sensitivity will be impaired just as much, I don't recommend using an RG-8 type coax except for short runs. It is much better to use one of the "hardline" cables. These cables do not have a braided shield at all. The outer shield of hardline cables has a solid aluminum or copper tubular conductor, which is how they get the name "hardline". The most common types have diameters of 1/2, 3/4, or 7/8 inch and a characteristic impedance of 50 or 76 ohms. Loss characteristics of hardline are much better than that of the RG-8 type. For example, 1/2-inch hardline has a loss of about 1 dB per hundred feet. This translates to 70% of our transmitter's output power reaching the antenna. The larger sizes have even less loss.

Sometime you might luck out and find a good deal on some hardline of the 50-ohm type. Much of the time you will not as I found out when looking for some 7/8-inch, 50-ohm hardline to use with my new moonbounce array for 2-meters. Since I was too cheap to buy any, my alternative was to use some of the commonly available

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Dick Kohlheas, W5UDM

3/4-inch, 75-ohm CATV transmission line and this is what I bought for less than the price of RG-213 braided coax!

Connectors are another problem but you will find that UG-21B male type N and UG-23B female type N connectors (phooey on PL-259's) can be mated to a bulkhead connector that is commonly available for the CATV hardlines.

But, you say, my antenna and rig are matched for 50-ohms and not 75 ohms. There are various ways to remedy this situation, some of which involve constructing matching sections or stubs that made the transmission line look like 50-ohms to the antenna and transmitter. The simplest method that I have found is to cut the 75-ohm line to a multiple of a half-wave length at the frequency of operation. Remember that transmission line theory says that the impedance of the load end of a line is seen at every half wavelength back down the line toward the transmitter. If you antenna is a good 50-ohm load, we are home free.

One method to use in "tuning" our line is to run the coax with the connector on the antenna end, temporarily put the connector on the end in the shack, and measure the SWR. Then you can trim a small amount of the coax away and reinstall the connector and take another measurement. By repeating this procedure you will find the halfwave point.

I don't care to have to do this much work so I will describe the method that I use. We will use the 2-meter band for an example. You should only have to cut the hardline once unless you make a mistake.

A few materials will be needed: a transmitter that covers the 2-meter band (a synthesized FM rig is fine), a good SWR Bridge or reflectometer, a good 50-ohm load (a Cantenna is not good enough), some graph paper and a calculator if you are lazy.

The first thing you must do is to predetermine about how long the coax must be. Let's say that we need a 90 foot length. Most 75-ohm CATV hardline has a velocity of propagation of about 0.81. We will also say that we want to use this coax in the low end of the band so we will cut it for use at 144.1 MHz.

(Thanks to the Carolinas—Virginia Repeater Assn. Repeater Journal, Feb. 1980)

Submitted by Karl White K4DQ

Next Month — the figures and formulas!

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PACSAT (cont.)

There are several purposes for providing such a system in the Amateur Satellite Service. PACSAT will provide a wide-availability vehicle for advanced experimentation, and a prototype system for a new class of satellite service involving reliable transmission of data to remote sites and isolated users, regardless of location. Several internationally-based organizations have expressed interest in just such capabilities, and this gives AMSAT the opportunity of spear-heading a potentially major new push in low-cost satellite systems, much in consonance with the F.C.C. charter for the Amateur Radio Service as a "proving-grounds" for new technology. The Volunteers in Technical Assistance (VITA), a non-profit firm dedicated to advancing the level of technological expertise of less-developed countries, is actively pursuing the coordination of such vanguard activities, and is working directly with AMSAT on the PACSAT development.

Other benefits result from the use of digital techniques. Considerable improvements may be made to emergency communications, as reliable, high availability links compatible with global mobile and portable radio service requirements are provided. Additionally, a spin-off benefit for AMSAT itself is the attracting of the new computer-aware members of the Amateur community into the Amateur Satellite Service.

A possible third set of benefits may be spun off the PACSAT system indirectly; the opportunity exists for designing new types of low-cost satellite launching and propulsion systems as a part of this next generation of Amateur spacecraft.

Such a system would provide a number of functions. In addition to the primary use as a world-wide store-and-forward link, or "flying mailbox", the PACSAT experiment could provide real-time regional linking (standard LEO amateur mode). As mentioned, both local network concentrators (gateways) and individual users could access the satellite. Finally, the system would provide the mechanism for advanced testing of network systems concepts, hardware, software and protocols to be used by packet radio networks in the future.

PACSAT System Description

PACSAT is an extraordinarily complicated system, rather similar in complexity to the Phase III spacecrafts. In addition to all of the required satellite support subsystems on board the spacecraft, there are two experimental packages, each consisting of multiple uplink channels, common downlink channels, and modems, coder/decoder link-access devices and control microprocessors with interfaces to a common satellite message processing unit (system control unit, or SCU). As if that isn't bad enough, the rigid packet environment demands structured ground stations with all of the familiar hardware (less the directional antennas, as we shall see), and perhaps several microprocessors for handling both the data stream and the automatic station control functions. The age of the microprocessor is upon Amateur Radio.

To ease the burden of trying to understand the whole system, PACSAT can be broken up into subsections, each with well-defined interfaces to other sections. A description of each section or interface follows. Please note that, although the conceptual design has been finished, many design groups are hard at work coming up with the specifications for their parts of the overall system, so that nothing below can be construed to be the "final word".

BOARD MINUTES

The Board of the Pikes Peak Amateur Association was called to order at 8:00 p.m., April 18th, at the home of Charlie, KC0TI. Present were Charlie KC0TI; Les, KC0NC; Mark, KA0JXW/DV; Bud, N0DDF; Kar, K4DQ; and Jake, N0CYR; and Tom AD0O.

Reports indicated the plans for the April 24 Swapfest were proceeding fairly smoothly and all should be ready by that Sunday. \$100 was advanced to Rosie Lewis, WA0MNL, for purchase of food. Jake indicated the chili was ready.

Some concern was expressed over available door prizes, and several people said they would check on the progress in this area. Mark, KA0JXW/DV, was given a check for \$100, payable to AES, in order to pick up the gift certificate for the computer. He will also pick up some AES donations.

Mark reported on the progress of the Sports Festival Committee. The commemorative station issue was still apparently undecided. There will be a control center for communications located in Vandenberg Hall at the AFA and a message center in the Fieldhouse and at Festival Headquarters. Members were receiving sign up sheets with their Zero Beats and Dave Stivers was to begin the scheduling soon.

The Board was informed that Mike K0TER, needs volunteers for the Walk for Mankind, May 14th, and should be contacted by those interested.

Charlie reported the novice classes have about eight people taking theory and 12 in code class. Some of these include members of the CAP.

Upcoming programs are: May — Sports Festival and testing stations for 2-meter rigs; June, the same as May. Mark formally questioned the quality and selection of ARRL films available from their library.

Mark was designated to write the Aurora Repeater Association thanking them for the donation of a table at their Swapfest April 16th.

A correction was noted in the minutes of Zero Beat as printed in the last issue. Paragraph number four should begin: "A mall demo . . ." and paragraph two should include the name of Harley Hanson, KC0TQ, as helping with the current novice class.

There being no further business before the board, the meeting was adjourned at 10:00 p.m.

Respectfully submitted,
Mark KA0JXW/DV

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We'll be closed Sat., Sun., and Mon. May 21-23 for Denver & Lamar Swapfests.

FCC EXTENDS COMMENT DEADLINE ON NO-CODE

At the request of the ARRL the FCC has decided to allow more time for comments on the proposed no-code licence. The new date is June 28. Remember, 7 (that's right seven) copies of your comment must be sent if you wish the commissioners to read your comments, rather than just placing them in the general file.

20 METER PHONE BAND EXPANSION

For those of you you haven't heard yet, the FCC has decided to expand the 20 meter phone band starting May 22nd at 0001 UTC. New sub bands will be: 14.150 to 14.175 Extra only; 14.175 to 14.225 Extra and Advanced only; 14.225 to 14.350 Extra, Advanced and General.

SPORTS FESTIVAL

As noted in the meeting announcement, sign up will continue for the festival at the meeting. It is important that we get an idea of what shape the communications will be in, by knowing who is working what, with what equipment, etc. In this issue is a sheet which contains a tentative schedule and an information sheet on your equipment and what events you want to work. Make a copy of the equipment sheet, fill it out and send to Dave WBOSSG at the address listed. Keep the original so you have the schedule, and a record of what information you sent to Dave.

Now is the time to come forward and get involved in this most ambitious and demanding public service event. Sign up early!!!

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UPCOMING SWAPFESTS

RMVHF Society — Boulder Armory — May 22
Talk In 16/76 and 52

Lamar Swapfest — National Guard Armory — May 22
S. of Lamar on Hwy. 287 — Talk In on 01/61 and 52

Colorado Repeater Group Picnic/Swapfest — May 21
At the High School next to Washington Park in Denver

Mountain Amateur Radio Club Swapfest — July 9 & 10
Red Rocks campground — North of Woodland Park
Talk In on 144, 56/145, 16, 37/97 and 52



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